ORIGINAL ARTICLES

SURGERY OF THE STOMACH AND DUODENUM*

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IN this presentation of the surgical treatment of lesions of the stomach and duodenum, owing to the time element involved, one of necessity must confine oneself to those lesions occurring most frequently, such as malignant lesions of the stomach, for the most part cancer, and benign ulcers of the stomach and duodenum. Even under these circumstances only the broader aspects of each can be discussed. For these reasons I shall present these subjects largely as they have been a part of the diagnosis and treatment by my colleagues and myself.

MALIGNANT LESIONS OF THE STOMACH

For the last two years detailed studies have been carried out in all cases with a diagnosis of malignant lesion of the stomach in which operation was performed at the Mayo Clinic from the year 1907 to 1938, inclusive. These studies have brought forth a great deal of important information substantiating, in many instances, clinical impressions which had developed over a period of years. I shall refer briefly to some of the most important.

Although it is rather difficult to classify the symptomatic picture presented by patients who had cancer of the stomach, it is an interesting commentary that approximately a third of the patients whose lesions were resectable had symptoms of the so-called ulcer type of dyspepsia and in practically the same proportion this ulcerous type of symptom complex appeared as the first symptom. Of even greater importance was the fact that when patients who had this ulcerous type of history were placed on an ulcer regimen 80 per cent had a temporary effective response with relief of pain, suggesting, therefore, a benign ulceration.

A little more than half of the patients presented what is commonly described as the usual picture of cancer of the stomach which refers to a symptom complex in which dyspepsia, associated with various degrees of disturbance of gastric motility and various degrees of decline, was present.

Roentgenologic Diagnosis.

On many occasions, I have emphasized the point that the roentgenologist has been of the greatest assistance to the internist and the surgeon in localizing gastro-intestinal lesions. The modern developments in the field of diagnosis, particularly roentgenologic, of lesions of the stomach and duodenum have decreased the possible error in failing to demonstrate lesions in a low percentage of cases and, when added to this is the opportunity to subject to gastroscopy patients who are believed to have gastric lesions, which fail to show in the roentgenogram, this incidence of possible error is reduced further to a marked degree. I have seen cases in which the roentgenologist was able to demonstrate gastric lesions no larger than one's fingernail. This is a great achievement because it enables one to recognize small lesions early, and early recognition is one of the ways in which better results will be obtained in the surgical treatment of gastric neoplasms. The fact remains, however, that there are some cases in which the roentgenologist is unable to determine whether the gastric lesion is benign or malignant, the roentgenologist's report being "gastric ulcer." It is in this group of cases that enthusiastic advocates of a routine course of medical therapy may delay operation to a time when extension or metastasis makes removal of localized malignant ulcerating lesions impossible.

In 1939, in 131 cases in which gastric resection was performed for malignant lesions of the stomach, the roentgenologist reported "malignant lesion of the stomach" in 109 cases, or 83 per cent. In approximately 10 per cent of the cases the gastric lesion was reported as "ulcer or ulcerating lesion, probably malignant" or as "ulcerating lesion, malignancy not ruled out." However, in approximately 7 per cent of the cases the report was of "gastric ulcer." In three of the nine cases in which the lesion was reported as "gastric ulcer" there was a malignant lesion of grade 4, in three cases of grade 3, in one case of grade 1, and in two cases grading was not done. In the 1907-1938 series, 10 per cent of the carcinomas were reported as gastric ulcers and 1 per cent as benign lesions.

Resectability.

In many instances roentgenologists at the clinic have attempted to progress even further in their efforts to aid the clinician and have expressed an opinion as to the operability of the lesions which they see roentgenologically. Of the cases in which roentgenologists had arrived at a diagnosis of operable malignant disease, the lesions in 48 per cent were removed. In a greater percentage of cases than this the lesions actually might have been removed, but direct extension of the neoplasm to adjacent vulnerable structures or the presence of nonremovable metastatic growths within the abdomen and apart from the stomach, conditions roentgenologists could not visualize, made radical removal inadvisable.

Of the cases in which operation was performed, in which roentgenologists considered the lesions to be inoperable or of doubtful operability, the lesions in 20 per cent proved to be removable. Conversely, of the carcinomatous lesions which at operation proved to be removable, 11 per cent had been considered by the roentgenologists to be inoperable or of doubtful operability. It must be emphasized that these percentages pertain to the series of cases being considered herein, namely, the cases of carcinoma in which the patients were operated on. In most of the cases in which the roentgenologist considered the lesions to be frankly inoperable, the patients did not undergo surgical exploration. In recent years, however, the percentage of patients

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who have been subjected to exploratory operation for carcinoma of the stomach has increased progressively, as the rate of resectability has increased. This increase in rate of operability has been due to the recognition that a definite percentage of those lesions reported to be inoperable are found at operation to be operable and in the rate of resectability because of willingness to remove, if possible, every malignant gastric lesion that has not metastasized to irremovable regions.

Treatment and Results.

Fifty-eight per cent of the 11,000 patients for whom diagnosis of malignant lesion of the stomach was made at the clinic between the years 1907 and 1938, inclusive, were subjected to surgical exploration in the hope that removal of the lesion would be found possible. In 45 per cent of this group of cases which is 26 per cent of the original total group in which the diagnosis of malignant gastric lesion had been made the lesions proved to be removable. It is interesting to compare this result with the management of malignant lesions of the stomach during 1939, during which time 66 per cent of the patients were operated on, the lesions in 43 per cent of the cases being removed. Of the total group of patients for whom the diagnosis of malignant gastric lesion was made at the clinic in 1939, 28 per cent had lesions which proved to be removable. In 1940, 260 patients (approximately 53 per cent of those for whom diagnosis was made) who had malignant lesions of the stomach were operated on; in 117 (45 per cent of the cases) partial gastrectomy was performed and in eight total gastrectomy was performed.

The average mortality rate for the 1907-1938 series of cases in which resection was done was 16 per cent. The mortality rate in 1939 for the 131 cases in which some form of resection was performed* was 11.5 per cent, and in 125 resections for malignant lesions in 1940 the mortality rate was 8.8 per cent (in eight of these cases total gastrectomy was performed). In thirty-three cases in which operation was performed for cancer of the stomach in 1939, because the lesions were irremovable, palliative operations, such as gastro-enterostomy, were performed with a hospital mortality rate of 12.1 per cent. This mortality rate emphasizes the high risk of palliative procedures for irremovable malignant lesions and, I believe, points to the need of conservatism in the employment of such conservative and palliative procedures, unless the lesion is producing almost complete obstruction, a condition which necessitates surgical intervention in order to enable the patient to leave the hospital and return home.

Survival rates.—The five-year survival rate for those patients who underwent resection is 29 per cent, and when this rate is adjusted for the normal death rate it is 32 per cent. The ten-year survival rate is 20 per cent, and when it is adjusted for the normal death rate, it is 25 per cent. The fifteen-year survival rate is 15.2 per cent;* twenty-year, 10.5 per cent; and the twenty-five year rate, 6.3 per cent.

Survival rate in relation to degree of malignancy.—Broders' index of malignancy for many years has been a most acceptable measuring stick and its accuracy is borne out in the present study, for in the five-year survivals after resection 86.2 per cent of patients who had lesions of grade 1 lived five years or more after leaving the hospital, 58.8 per cent who had lesions of grade 2, 30.2 per cent of grade 3, and 23.3 per cent of grade 4.

Survival rate according to metastasis and extension.—In cases of 1,951 patients who underwent resection the factors of metastasis and extension were studied to determine their effect on the prognosis. In cases with no extension or metastasis, 44.7 per cent of the patients lived five years after leaving the hospital. When there was direct extension of the lesion to adjacent tissue which was removed with the lesion, 39.1 per cent of the patients lived five years. When metastasis was present, 17.3 per cent lived five years. When metastasis and direct extension were present, 17.1 per cent lived five years.

Survival rate as related to age.—It is commonly believed that malignant lesions as they occur among younger patients are more fulminating than those which afflict older persons and that, therefore, the results of treatment of carcinoma among younger persons are considerably poorer than the results obtained for patients in the older age groups. In this study the five-year survival rate was calculated according to the age of the patient at the time of operation, and it was found that for patients less than forty years of age the survival rate was 25.1 per cent (26 per cent when adjusted for normal death rate), in contrast to the survival rate of 29.7 per cent for patients from forty to forty-nine years of age (31.2 per cent when adjusted for normal death rate); the five-year survival rate of patients fifty to fifty-nine years of age was 29.2 per cent (32.2 per cent when adjusted for normal death rate), 28.9 per cent for patients sixty to sixty-nine years of age (35.8 per cent when adjusted for normal death rate) and 29.8 per cent for patients seventy years or older (49.3 per cent when adjusted for normal death rate).

The hospital mortality rate for younger patients was considerably lower than for older patients. Among the twenty-four patients in the age group from twenty through twenty-nine years who underwent resection no deaths occurred. The mortality rate among 183 patients in the age group from thirty through thirty-nine years was 5 per cent and among 563 patients between forty and forty-nine years it was 10 per cent. In the age group from fifty years upward, the mortality rate increased progressively by decades, being 24 per cent among 179 patients aged seventy years or more. The average mortality rate in the 2,772 cases of resection for carcinoma of the stomach for all age groups was 16 per cent. Therefore, in a consideration of those patients between thirty and thirty-nine years

* One hundred and twenty-five cases of partial gastrectomy, four of total gastrectomy, and two of local excision. The mortality rate for the 125 cases of partial gastrectomy was 10.4 per cent.

* Survival rate beyond ten years approaches that of the normal population.

of age who undergo surgical exploration for carcinoma, the chance for a five-year cure is about the same as it would be for patients of older ages, provided, of course, that the lesion is operable and is removed.

Sarcoma of the Stomach.

The discussion thus far has taken into consideration all malignant lesions of the stomach. It might be of interest, however, to call attention to the fact that in the series of patients (6,352 patients) who were operated on for malignant lesions of the stomach, in 110 cases, or 1.7 per cent, the lesions were sarcoma. Of this number, sixty-eight resections were performed with a mortality rate of 13.2 per cent, whereas palliative operations were performed in seven cases with a mortality rate of 14.3 per cent. These mortality rates closely approximate those for carcinoma, but the interesting difference between sarcoma and carcinoma is apparent in the distribution according to age and sex, for 24.5 per cent of the patients who had sarcoma were less than forty years of age, whereas but 6.9 per cent of those who had carcinoma of the stomach were less than forty years of age.

GASTRIC ULCER

In 1940, 106 (approximately 48 per cent) of those patients for whom a diagnosis of gastric ulcer was made were operated on.

Experience has shown that in the evolution of treatment, cycles occur. This phenomenon may be due to the changing incidence of the disease or to its severity. Of great influence, of course, are the results which follow different methods of treatment. Generally speaking, response to conservative methods of treatment is more likely to occur when economic and social changes have improved the general health of the community. Under such circumstances, routine methods of therapy may produce an increasing incidence of benefit or cure, which increases further when improved methods of therapy are developed and instituted.

These remarks apply particularly well to the treatment of gastric ulcer. As a result of a better understanding of this lesion and its earlier recognition, while the lesion is still small and without the complicating features of hemorrhage, perforation and obstruction, relief of symptoms and healing of the ulcer have resulted from a medical regimen in more cases recently than many years ago. The only objection to a medical regimen in all such cases is that in some of them the lesion, instead of being a small gastric ulcer, is in reality an ulcerating carcinoma. In many such cases roentgenologic or gastroscopic examinations will not assist in the differential diagnosis. It has been said that a trial course of medical treatment serves as a diagnostic aid, for, if the patient is relieved of symptoms, if roentgenographic examination demonstrates that the ulcer has disappeared, and if blood disappears from the stools, then the lesion is benign. Clinical experience, however, has demonstrated that in some cases of malignant gastric ulceration these criteria may seem to be satisfied but that the lesion does not heal; it only seems to do so, for, as Schindler has shown, the carcinomatous process may extend from the margin of the ulcer into the crater, obliterating it.

The incidence of malignant changes in gastric ulcers has been stated to be from 10 to 20 per cent. Walton said that the figures of Stewart now are generally accepted. He concluded that in 9.5 per cent of cases chronic ulcer becomes carcinomatous and that carcinoma originates in a chronic ulcer in 17 per cent. Katsch, however, reported an incidence of 20 per cent. Finsterer found that in 532 cases of resection for gastric ulcer the ulcer was carcinomatous in 141, an incidence of "20.9 per cent."

The possibility of healing a large gastric ulcer with a crater 1.5 centimeter or more in diameter by other than surgical methods should be looked on with skepticism, for all such ulcers have a tendency to perforate. Patients who have such lesions usually have had clinical evidence of perforation of the ulcer either to the gastrohepatic omentum or to the pancreas, and many of them have had hemorrhages. When such lesions occur, surgical removal of the lesion affords the best chance of permanent cure and does it in a reasonably short time. This statement is true regardless of the age of the patient if his condition is otherwise satisfactory. Furthermore, surgical removal relieves the menace of fatal hemorrhage from the lesion or of an acute perforation which may require an emergency procedure for its closure. Of great importance is the removal of a lesion which may be malignant or may become so.

The risk of the operation for gastric ulcer should not exceed a maximum of 5 per cent, and it is possible to operate on a large series of patients who have gastric ulcer with a mortality rate of considerably less than 5 per cent. In point of fact, in 278 cases in which partial gastrectomy was performed at the Mayo Clinic in 1939 for benign ulcers of the stomach or duodenum, the mortality rate was 4 per cent. Partial gastrectomy for gastric ulcer was performed in eighty-nine cases with a mortality rate of 2.2 per cent. In 1940, partial gastrectomy for gastric ulcer was performed in eighty-eight cases with one death; excision or gastro-enterostomy, or both, were performed in seventeen cases with no death. The cases were selected carefully, and partial gastrectomy was performed only when the nature of the lesion and the condition of the patient warranted this procedure. The results of a properly chosen, properly performed operation for gastric ulcer are some of the best in surgical practice, for recurrence of the ulceration is rare. I have not seen recurrence of gastric ulcer or gastrojejunal ulcer after partial gastrectomy for gastric ulcer when half or more of the stomach has been removed. Recurrence of ulcer, in my experience, is rare when the gastric ulcer has been excised and gastro-enterostomy performed.

In the experience of the clinic the large gastric ulcers are most frequently present along the lesser curvature of the stomach or slightly posterior to it. On reviewing 272 cases of chronic gastric ulcer in which operation was performed at the Mayo

Clinic from January 1, 1933, to December 31, 1936, inclusive, Clagett and I [28] found that 66.9 per cent of the ulcers were at or above the incisura angularis, 15 per cent were on the posterior wall and 1.5 per cent were on the greater curvature. The remainder were below the incisura angularis.

In several of the cases at the clinic the ulcer appeared, on roentgenologic examination, to be located very high on the lesser curvature, and for this reason it was thought that operative removal would be difficult; it was found at operation, however, that perforation of the lesion to the capsule of the pancreas had given an erroneous idea of the amount of the stomach between the ulcer and the esophagus. In these cases there was actually much more uninvolved stomach than the roentgenogram indicated. On other occasions the early division of the gastrohepatic omentum at a very high level assisted in mobilizing the upper part of the stomach so that unusually high lesions could be removed without too great difficulty. Two observations led me to study a series of patients operated on for benign and malignant lesions situated midway between the incisura angularis and the esophagus or higher. These were as follows: (1) Recognition of the fact that the roentgenologic appearance of a gastric ulcer can be so misinterpreted that necessary surgical procedures may be postponed; and (2) a general impression that, although removal of a gastric ulcer is made more difficult when it is situated above the incisura angularis, the mortality rate from the operation is not increased appreciably.

During 1938 and 1939 at the Mayo Clinic there were forty-two cases in which operation was performed for benign lesions situated in the cardial region of the stomach, with one death, a mortality of 2.4 per cent. Thirty-five patients who had cardial benign gastric ulcers were operated on. In twenty-six cases partial gastrectomy was done for cardial gastric ulcer, with one death, a mortality of 3.8 per cent. In four cases the ulcer was excised, and gastro-enterostomy was performed. In one case excision of the ulcer was done, and in four cases gastro-enterostomy was performed. In these nine cases there were no deaths. In three the lesions removed were polyps; in two, diverticula; in one, a leiomyoma, and in one, a cyst. Local excisions were performed in six of these seven cases, and partial gastrectomy was performed in one. There were no deaths.*

I have referred to these cardial ulcers because frequently I have seen patients with such lesions in whom the excuse for a course of medical treatment, even though the lesion was large and in many cases had been complicated by hemorrhage, was that the lesion was probably located too high to be removed safely. The fallacy of this opinion is borne out not only by the fact which has been brought out, namely, that the lesions appear roentgenographically to be higher than they really are, but in a group of cases in which such lesions were removed surgically, the operative mortality was only slightly higher than that for similar operations for gastric ulcer located at the lower levels on the lesser curvature or the body of the stomach.

There are several satisfactory procedures that may be employed in the surgical treatment of gastric ulcer. The procedure of choice is partial gastrectomy with removal of the lesion. The advantages of this procedure are the removal of the lesion with its possible hemorrhage, perforation or malignant degeneration, riddance of associated pylorospasm and induction of a high incidence of relative achlorhydria with almost total absence of gastrojejunal ulceration. The Polya type of end-to-side anastomosis posterior to the colon is utilized most frequently. If the lesion should prove, on microscopic examination, to be malignant, its removal by partial gastrectomy gives the patient the best chance of cure, for the procedure removes the lymphatic regions in the excised portion of the gastric wall and in the adjacent gastrocolic and gastrohepatic omenta, which might harbor malignant cells that extended from the original lesion.

Study was made of the results in the 272 consecutive cases of gastric ulcer for which operation was performed at the clinic; partial gastrectomy was performed in 162 of these cases. Although the operation of partial gastrectomy for gastric ulcer gives almost uniformly good results without recurrence of ulceration, when partial gastrectomy cannot be safely utilized, on account of the poor general condition of the patient or the nature of the lesion itself, surprisingly good results may be obtained by less radical methods, such as excision of the ulcer with gastro-enterostomy or occasionally excision of the ulcer alone.

DUODENAL ULCER

During 1939, 2,729 patients who had duodenal ulcer were examined at the clinic and operation was performed in 467, or 17.1 per cent of the cases. In 1940,[33] at the clinic 13 per cent of the patients with duodenal ulcer were operated on.

In 1936, before the meeting of the Western Surgical Association, I [25] presented a paper on the topic, "Should Gastric Resection Be Done for Duodenal Ulcer?" At that time I called attention to the fact that, although it had been the custom in the Mayo Clinic as early as 1905 to perform partial gastrectomy in the treatment of large, calloused gastric ulcer, because of the possibility of the lesion being malignant, the more conservative procedures of gastro-enterostomy or excision of duodenal ulcer, with plastic operations involving the lower portion of the stomach and the duodenum, had been the surgical procedures of choice for patients having duodenal ulcer who had failed to obtain relief of symptoms on a medical regimen. Since that time an increased percentage of patients operated on for duodenal ulcer has undergone partial gastrectomy, and an attempt has been made to formulate a definite opinion of the indications for and against the operation.

* In thirty-four cases in which cardial carcinoma was present, surgical treatment was possible. In all but one, gastric resection was performed; that is, partial gastrectomy in twenty-eight and total gastrectomy in five. In these thirty-four cases the mortality rate was 14.7 per cent. The mortality rate for operations for malignant disease in the upper part of the stomach is in keeping with that following partial gastrectomy performed for all types of carcinomas of the stomach in the year 1938 [32] at the clinic, which was 13.5 per cent (126 cases).

In 1940, partial gastrectomy was performed in 140 cases for duodenal ulcer and gastro-enterostomy in 203 cases. In order to discuss the rationale of the development of partial gastrectomy in the treatment of duodenal ulcer it will be worth while to refer briefly to some of the principles involved in usage.

Gastrojejunal Ulceration.

In the early 1920's, Lorenz and Finsterer gave as their main reason for advocating gastric resection for duodenal ulcer, that the procedure was followed by reduction in incidence of gastrojejunal ulcer to one per cent or less, in contrast to an incidence of at least 10 per cent, reported by Lorenz,[15] subsequent to gastro-enterostomy performed in Austria. The reason for this reduction in the occurrence of gastrojejunal ulcer was stated to be that achlorhydria occurred subsequent to gastric resection and hence recurring gastrojejunal ulceration could not take place. However, since the risk of partial gastrectomy was greater than that of gastro-enterostomy, and since in partial gastrectomy the considerable part of the stomach which was removed usually did not give evidence when examined by the pathologist of the marked degree of gastritis present in cases reported in Germany; and, further, since the conservative operations of gastro-enterostomy had been followed in many clinics by an incidence of recurrent ulceration of not more than 4 per cent, little enthusiasm was aroused in the United States for partial gastrectomy in the treatment of duodenal ulcer. There were, however, two groups of surgeons in two separate regions of the United States, who had adopted the procedure. The surgeons in these groups had adopted it because, in their experience, a relatively high incidence of gastrojejunal ulceration occurred subsequent to more conservative procedures.[13,14] Their patients were, for the most part, of one race, in which the percentage of intermarriage is exceedingly high. In the years that followed, largely as a result of the interest of these two groups of men who, in their experience, had been able to reduce the incidence of gastrojejunal ulcer in their cases to 3.1 per cent [3] as a result of the adoption of partial resection for duodenal ulcer, increasing interest in partial gastrectomy for duodenal ulcer appeared.

With the accumulation of larger series of cases in which partial gastrectomy had been performed for duodenal ulcer, it became apparent that ulceration did recur even after subtotal gastrectomy. Usually the patients were found to have persisting free hydrochloric acid in the gastric contents and the erroneous conclusion was drawn that an insufficient amount of stomach had been removed. This opinion later was modified in this country, for in 108 cases reported from one eastern hospital in which partial gastrectomy or subtotal gastrectomy was performed for duodenal ulcer, relative achlorhydria occurred in but approximately 56 per cent.[10] Of greater significance, it seems to me, was the fact that in 44 per cent of the cases hydrochloric acid persisted or recurred in gastric secretion, and in nine cases gastrojejunal ulceration developed. In taking the series of 108 cases reported from this eastern hospital as a group, the incidence of gastrojejunal ulcer after partial gastrectomy was found to be 8.3 per cent.[10] With the general recognition of the fact that gastro-enterostomy carried a much lower surgical mortality rate [2] than partial gastrectomy,[3] and of the fact that, in our experience at the Mayo Clinic, as well as in the reports of other surgical clinics, gastrojejunal ulcer appeared in approximately only 3.2 per cent of cases,[2] we could not see the necessity for the routine performance of partial gastrectomy for primary duodenal ulcer, on a comparative basis of formation of gastrojejunal ulceration.

Gastritis.

The next wave of enthusiasm favoring partial gastrectomy for duodenal ulcer had its origin subsequent to the work of Konjetzny, Puhl, and others, who emphasized the high incidence of gastritis associated with duodenal ulcer noted among German surgical patients, and it was thought by these observers that gastritis was the forerunner of the development of the duodenal ulceration. This high incidence of ulcerative hemorrhagic gastritis, stated to be characteristic of from 99 to 100 per cent of German patients operated on for duodenal ulcer,[11,12] led Snell and me,[31] in 1931, to visit various surgical clinics in Germany, Austria, and Hungary. In studying the resected portions of the stomachs of patients operated on for duodenal ulcer in those countries, as well as specimens previously removed by Schmieden at Frankfurt, Snell and I were impressed by the high incidence of gastritis present in the German cases in contrast to the very low incidence of gastritis associated with duodenal ulcer among patients on whom I had operated at the Mayo Clinic. These observations were published in a series of papers in the years 1931 to 1933,[4,20,22,23,24,27] and the accuracy of the observations was confirmed by Sebening, of Schmieden's clinic, who spent several months in study at the Mayo Clinic. The very infrequent occurrence of gastritis among patients operated on at the Mayo Clinic for duodenal ulcer, in comparison with those operated on at the German clinics, is probably explainable on the basis of so-called geomedical variation of types of lesions and by the part played by racial factors in these differences, which has been commented on by von Haberer and by Schittenhelm. The latter, gathering data from various parts of Germany, has emphasized the fact that disease frequently presents different characteristics even in localities where it first appeared. Quoting briefly from Schittenhelm's report: "Apoplexy, atherosclerosis, and thrombosis are more frequent at Basel than at Kiel. Gastric and biliary disorders, likewise, present distinct regional differences—the part played by racial factors in these differences is as yet unknown to science." Further lending support to the geomedical differences in gastritis associated with duodenal ulcer, is the fact that in a paper published by Aschner and Grossman, gastritis was reported as existing in approximately 60 per cent of the portions of stomach resected for duodenal ulcer in contrast with its

presence in less than 12.5 per cent of the series of resected gastric specimens on which I reported from the Mayo Clinic, where in a series of cases partial gastrectomy had been performed for duodenal ulcer.[4,27] The corollary of this would seem to be, therefore, that, since, in our experience, gastritis has been such an infrequent accompaniment of duodenal ulcer, any argument directed toward the value of removing such areas of gastritis in the performance of partial gastrectomy for duodenal ulcer could not be used in favor of such a procedure in cases of the type in which we usually operate.

Partial Gastrectomy for Duodenal Ulcer.

Having discussed and eliminated, I believe, the factor of gastritis as an indication for partial gastrectomy in the cases in which we have operated, and having stressed the low incidence in several series of cases of recurring ulceration after gastro-enterostomy, in contrast with a much higher incidence of recurring ulceration after partial gastrectomy in another series of cases, the important matter to be settled would appear to be just what partial gastrectomy accomplishes in a better fashion than either gastro-enterostomy or pyloroplasty. That question, it seems to me, can be answered rather briefly in the statement that partial gastrectomy accomplishes greater reduction of free hydrochloric acid in the gastric secretion (provided the Polya type or the Hoffmeister-Polya type of anastomosis is made) and in a greater percentage of cases than does gastro-enterostomy or pyloroplasty. Friedell[6] and I have found that relative achlorhydria will occur in approximately 75 per cent of cases in which the Polya type of partial gastrectomy is performed (provided an entero-anastomosis is not made) in contrast with the occurrence of relative achlorhydria in 10 per cent of cases after gastro-enterostomy.[29] Of equal interest is the comparative infrequency, in my experience, with which relative achlorhydria is obtained after gastric resection for duodenal ulcer when the Billroth I type of anastomosis is made; in other words, when the end of the stomach is sutured to the duodenum after resection of half or two-thirds of the stomach. This result is in rather marked contrast with the changes in acidity which follow similar procedures carried out in the treatment of gastric ulcer.

Resistance of Tissue.

Such a discussion of gastric acidity is important, in spite of the fact that gastric acidity plays a secondary part in the formation of either a duodenal or a gastrojejunal ulcer. Resistance of tissue or susceptibility of tissue to inflammation or ulceration from the hydrochloric acid or gastric secretion is that on which successful surgical treatment or duodenal ulcer depends, for, if tissue is resistant to hydrochloric acid, the patient will obtain an excellent result from the recognized types of surgical procedures without recurring ulceration, whereas if the tissue is susceptible to recurring ulceration, and if hydrochloric acid of the gastric secretion continues to be in contact with such susceptible tissue, ulceration may recur. Unfortunately, there is no way at present to measure, *in vivo,* in the individual case, resistance of intestinal tissue to gastric secretion.

What place, then, has partial gastrectomy in the treatment of duodenal ulcer? Theoretically it would appear that it has a place in the treatment of hemorrhagic duodenal ulcer, principally because it removes the bleeding lesion and is able to assure the patient a maximal degree of reduction of gastric acidity. In a recent study by Cleveland[30] of a series of patients operated on for bleeding duodenal ulcer at the Mayo Clinic during the years 1932 to 1936, on whom partial gastrectomy was performed, 94 per cent of the patients obtained satisfactory results and had no further occurrence of ulcer pain or hemorrhage in the period of four to eight years which had elapsed since their operation. Recurring hemorrhages, however, have been reported after gastro-enterostomy in 23 per cent of cases. Yet in many cases of bleeding duodenal ulcer gastro-enterostomy suffices to heal the duodenal lesion. Partial gastrectomy has an important place in the treatment of recurring duodenal ulceration and in gastrojejunal ulceration. The reasons for its usefulness in this group of cases are similar to those for its usefulness in the treatment of bleeding ulcers, namely, that it gives the patient a maximal reduction of gastric acidity. It has an important place among that group of patients who are unable to be selective of diet, working conditions, and habits subsequent to operation, and it will have a place in the treatment of the patient who has duodenal ulcer and whose tissue is abnormally susceptible to recurring ulceration from the irritating effects of hydrochloric acid in gastric secretion.

In 1939,[7,17,26] at the clinic 18 per cent of the patients for whom diagnosis of duodenal ulcer was made were treated surgically. Of this group of 413 patients, 186, about 45 per cent, were subjected to partial gastrectomy. In 1940, approximately 13 per cent of patients seen at the clinic for whom diagnosis of duodenal ulcer was made were operated on, and in 40 per cent of these cases partial gastrectomy was performed.

During the last five or six years the use of local operations at the outlet of the stomach in the treatment of duodenal ulcer has decreased until these procedures seldom are employed (1.4 per cent of cases in which operation was performed for duodenal ulcer in 1940). During the last five-year period at the clinic, gastro-enterostomy has been performed in more than one thousand cases for chronic and subacute duodenal ulcer, with a mortality rate of 2.1 per cent. During this same interval, partial gastrectomy was performed in about 500 cases, also for similar lesions, with a mortality rate of 4.1 per cent. During 1940 the mortality rate in 140 cases in which partial gastrectomy was performed for duodenal ulcer was 4.3 per cent.

Although this mortality for gastric resection is not high, nevertheless it is definitely higher than that for gastro-enterostomy, and this fact should always be kept in mind in selecting the operation for a given patient.

In order to see whether this increase in risk was justified in the results which followed, Dr. E. B. Lewis, Dr. Robert G. Lemon and I [34] carried out a study of 212 consecutive cases in which primary partial gastrectomy of the Polya type had been performed for duodenal ulcer. Although this was a consecutive series of cases in which partial gastrectomy had been done, it is not to be assumed that it was a consecutive series in which the patients were operated on for duodenal ulcer, for in many cases the large size or the character of the ulcer or the condition of the patient would not permit partial gastrectomy without excessive risk; in such cases gastro-enterostomy usually had been performed.

Anastomotic jejunal ulceration occurred after partial gastrectomy in 2.5 per cent of the cases studied. Thus, in a total of 97.5 per cent recurrence of ulceration after partial gastrectomy did not occur. After the operation, 83.5 per cent of patients were well without undue restriction of diet or activity. Because of vagotonic symptoms such as temporary faintness and sweating after meals, 14 per cent required restriction of diet or activity.

In those cases in which analyses of gastric contents were obtained after operation, anacidity was present in two-thirds to four-fifths of those in which recurrent ulceration did not occur, and only rarely was a normal or greater than normal value for free acid obtained. When a jejunal ulcer was demonstrated, almost invariably greater than normal amounts of free acid were present.

In presenting the results of partial gastrectomy for bleeding lesions of the stomach and duodenum at the meeting of the American Surgical Association last week, Cleveland and I [30] called attention to two facts which I think should be kept constantly in mind by those surgeons contemplating partial gastrectomy for duodenal ulcer, namely, that failure to remove the pylorus and the performance of an entero-anastomosis between the loops of jejunum were responsible for practically the only instances of recurring ulceration which occurred. Experimental and clinical evidence points to the fact that when the pylorus is allowed to remain, the marked reduction of gastric acidity which occurs when the pylorus is removed in the course of partial gastrectomy does not occur. This evidence indicates that in the pyloric region, factors stimulating the production of gastric acidity are present.

In twenty cases in which Ogilvie of London performed partial gastrectomy and did not remove the pylorus, recurrence of ulceration took place in five, whereas in one hundred cases in which pylorectomy was done as a part of the partial gastrectomy recurrence did not take place. The effect of entero-anastomosis is to prevent the dilution of gastric secretion and the reduction of gastric acidity by the reflux of alkaline duodenal contents into the gastric pouch. Although it must not be assumed that in every case in which entero-anastomosis has been performed ulceration is likely to recur, nevertheless the fact remains that the cases of bleeding gastric and duodenal ulcer in which there was failure to obtain excellent results after partial gastrectomy were, for the most part, those in which the pylorus had not been removed or an entero-anastomosis had been made or a Billroth I type of operation performed. A corollary of this, it seems to me, is the fact that in a given case in which it is desired to perform partial gastrectomy for duodenal ulcer there must be sufficient normal uninvolved duodenum distal to the duodenal ulcer so that the ulcer can be removed and the duodenum accurately closed, or if the ulcer is too large and is situated too low for removal, there should be sufficient normal duodenum between it and the pylorus so that this portion of the duodenum can be accurately closed and leakage obviated, for in most cases leakage from the duodenal stump is the cause of the patient's failure to recover from the operation.

SUMMARY

The frequency of the ulcer type of syndrome in cases of malignant lesions of the stomach and the temporarily effective response of patients to a medical regimen is noteworthy. Of equal importance is the fact that such a syndrome was the first indication of malignant gastric disease in approximately a third of the presented cases in which operation was performed.

The accuracy of roentgenologic diagnosis in cases of lesions of the stomach and duodenum is well known, but it is less well known that there are definite groups of cases in which radiologic examination reveals lesions which appear to be gastric ulcers, but which on pathologic examination prove to be carcinomas, sometimes of high degree of malignancy. This fact should be repeatedly emphasized. In 10 per cent of a large series of cases in which gastric resection was performed from 1907 to 1938, inclusive, for malignant lesions, preoperative diagnosis of gastric ulcer had been made roentgenologically. In the year 1939, diagnosis of gastric ulcer was made in 7 per cent of the cases in which gastric resection for cancer was performed. In 20 per cent of the cases in which the lesion was reported on roentgenologic examination to be inoperable or of doubtful operability, it was found on surgical exploration to be operable.

The five-year survival rate for those patients who underwent resection is 29 per cent, and when this rate is adjusted for the normal death rate it is 32 per cent. The ten-year survival rate is 20 per cent, and when it is adjusted for the normal death rate, it is 25 per cent. The fifteen-year survival rate is 15.2 per cent; twenty year, 10.5 per cent; and the twenty-five year, 6.3 per cent.

Although many small gastric ulcers will heal under medical regimen properly carried out, the possibility of the lesion being an ulcerating carcinoma which, in roentgenograms, simulates a gastric ulcer must always be remembered, and since the likelihood of large chronic gastric ulcers healing medically is very small, surgical treatment should be carried out in such cases. The operative mortality, under proper circumstances, in these cases should not exceed 4 or 5 per cent.

The treatment of duodenal ulcer has undergone considerable revision in the United States in the

last ten years. As a result of a decreasing percentage of patients who have duodenal ulcer for whom surgical procedures are advised, more radical procedures have been carried out; hence the increasing percentage of cases in which partial gastrectomy, rather than pyloroplasty or gastroenterostomy, has been performed. There is a definite place for gastro-enterostomy in the treatment of duodenal ulcer, and experience has shown that partial gastrectomy is the preferable surgical procedure in certain groups of cases, particularly those of hemorrhagic ulcer and those of ulcer diathesis, as well as in those cases in which the patients cannot be expected to follow a regulated regimen of diet and habits subsequent to operation.

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THE PRACTITIONER AND PROBLEMS OF DIABETES*

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IN the capacity of an internist rather than as a specialist, I have elected to discuss certain general problems which confront the practitioner in relation to problems of diabetes. This afternoon I should like, at the outset, to make a plea for the viewpoint that diabetes can and should be treated more generally by the practitioner. The high incidence of diabetes among the population in itself justifies this point of view. Furthermore, treatment has been simplified to an extent whereby the vast majority of cases today afford but few problems in which special knowledge is necessary. This idea constitutes merely part of a general thesis, namely, that the place of the specialist in the various branches of internal medicine, including diseases of the circulatory system, the gastro-intestinal tract, the respiratory system and the kidneys should be consultatory and reserved for the exceptional case.

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